Journal of Artificial Intelligence and Cyber Security (JAICS)
An International Open Access, Peer-Reviewed, Refereed Journal

Vehicle To Vehicle Communication for Intelligent Transportation

[1]Dr.S.Sathiya Priya, [2] Dr.V.JeyaRamya, [3]Ashwin Kumar. N. A, [4] Manish Kandan K, [5]Pattabiraman M

[1]*Professor, Department of Electronics and Communication Engineering, Panimalar Institute of Technology, Chennai.*
[2]*Associate Professor, Department of Electronics and Communication Engineering, Panimalar Institute of Technology, Chennai.*
[3,4,5] *UG student, Department of Electronics and Communication Engineering, Panimalar Institute of Technology, Chennai*

[1] priya.anbunathan@gmail.com,[2] Jeyaramyav@gmail.com, [3] Naashwin2004@gmail.com, [4]manish7812003059@gmail.com, [5]pattabiraman.m99@gmail.com

Abstract: Real time data sharing between vehicles through V2V communication has been presented as a possible solution to improve traffic efficiency and reduce road safety issues which are major problems in contemporary transportation systems on account of rapid growth in vehicle traffic. This paper describes a real-time V2V communication system implementation that uses wireless communication technologies to enable vehicles to transmit vital information, including position, speed, and emergency alarms. The system helps increase drivers' situational awareness and their proactive decision-making by providing low-latency, secure, and reliable message transmission. Results from experiments show better reaction times, less chance of accidents, and better traffic flow. V2V communication offers collision avoidance techniques that are quicker and more efficient than those found in traditional warning systems. The suggested solution is intended to support the advancement of Intelligent Transportation Systems (ITS) by being scalable and responsive to various traffic situations. Furthermore, security measures like authentication and encryption are put in place to stop data manipulation and unwanted access. To find the best strategy for real-time applications, the study also investigates a number of wireless communication protocols, such as LoRa, Wi-Fi, and DSRC. In order to further improve transportation efficiency and safety, future improvements will incorporate AI-based predictive analytics and expand into Vehicle-to-Infrastructure (V2I) communication.

Keywords- Intelligent Transportation System (ITS), Vehicular Ad-hoc Network (VANET), Low-Latency Communication, Network Congestion Management, Artificial Intelligence in Transportation, Cybersecurity in V2V Communication.

1. INTRODUCTION

The rapid advancement of vehicle technology has substantially influenced current transportation systems, making them safer, more efficient, more intelligent. However, despite the incorporation of advanced driver-assistance systems (ADAS) such as sensors, radars, and cameras for collision avoidance, road accidents remain a global concern, contributing to thousands of fatalities and severe injuries each year. A key contributing cause to these incidents is the lack of real-time communication between cars, which prohibits drivers from making proactive decisions to avoid collisions. While classic vision-based systems enhance safety by identifying adjacent impediments, they are sometimes limited by environmental conditions such as fog, rain, and obstructions in the driver's field of sight to overcome this difficulty, Vehicle-to-Vehicle (V2V) communication has developed as a critical component of Intelligent Transportation Systems (ITS). V2V communication enables vehicles to transmit crucial information, such as speed, location, acceleration, and braking status, in real time. This wireless communication network allows vehicles to communicate situational data, letting drivers and automated systems react to potential risks before they become serious threats. Unlike conventional radar-based safety measures, V2V systems transcend direct visual constraints by relying on a network of connected vehicles, making road mobility safer and more efficient.

Despite technological breakthroughs in collision avoidance systems, accidents remain prevalent due to delayed driver responses and unpredictable traffic conditions. V2V communication directly tackles these difficulties by providing cooperative awareness among vehicles. By continuously exchanging real-time information, V2V

networks can avert risky scenarios such as rear-end collisions, lane-change conflicts, and intersection crashes. In addition to accident prevention, V2V communication enhances traffic management by optimizing vehicle flow, reducing congestion, and boosting fuel efficiency. As autonomous and connected vehicles become more ubiquitous, the importance of V2V communication will only expand. Emerging technologies like as 5G, Dedicated Short-Range Communication (DSRC), and Cellular V2X (C-V2X) are being researched to enhance V2V communication dependability, assuring low latency and safe data sharing. This project focuses on establishing an effective Vehicle-to-Vehicle (V2V) communication infrastructure that promotes road safety and transit efficiency. The primary objectives of the project include developing a robust V2V communication system that enables seamless real-time data exchange between vehicles, ensuring low-latency communication to provide timely alerts for accident prevention, enhancing security and privacy by implementing encrypted data transmission protocols, mitigating network congestion by optimizing communication protocols for high-density traffic environments, improving vehicle coordination through predictive analysis, enabling better decision-making in dynamic traffic conditions, and integrating V2V technology with intelligent traffic management systems to optimize overall road efficiency.

Governments and organizations worldwide are aggressively supporting V2V communication as part of their intelligent transportation projects. Programs such as the U.S. Department of Transportation's (USDOT) Connected Vehicle Program and the European Cooperative Intelligent Transport Systems (C-ITS) attempt to integrate V2V communication into current road networks to lower accident rates and enhance overall traffic efficiency. However, one of the primary problems in large-scale V2V deployment is the necessity for standardization. Different countries and automakers are researching various communication systems, and maintaining global compatibility remains a critical concern The future of V2V communication seems promising, with ongoing research concentrating on edge computing, quantum-safe encryption, and seamless integration with 5G and future 6G networks. Researchers are also researching hybrid V2V-V2X models, where vehicles interact not only with each other but also with infrastructure, pedestrians, and other road users. By tackling existing obstacles and exploiting upcoming technology, V2V communication can change modern transportation systems, leading to safer roads and an intelligent, fully linked driving ecosystem Despite its benefits, V2V communication faces various obstacles, particularly in cybersecurity and data privacy. Since V2V relies on wireless communication, it is subject to hacking, spoofing, and unwanted access. To ensure secure data sharing, researchers are studying new encryption approaches, blockchain-based security frameworks, and anomaly detection systems to defend automobiles from cyber threats. Establishing a comprehensive cybersecurity framework is important to earning public trust and enabling mass deployment of V2V technologies.

Implementing a real-time V2V communication architecture has the potential to improve road safety and transportation systems. By enabling vehicles to behave as active nodes in a cooperative driving environment, this technology can drastically cut accident rates, improve emergency response times, and build a platform for completely autonomous driving. Furthermore, smart traffic management powered by V2V technology can boost urban mobility, cut fuel consumption, and minimize carbon emissions, contributing to a sustainable future. This project intends to bridge the gap between present traffic safety measures and future intelligent transportation solutions by building an efficient, reliable, and scalable V2V communication system. Through this initiative, developments in V2V communication can be utilized to build safer, smarter, and more connected transportation networks, ultimately paving the way for a more secure and intelligent roadway infrastructure.

2. LITERATURE SURVEY

A VANETs, or vehicular ad hoc networks: The fundamental technology for vehicle-to-vehicle (V2V) communication, Vehicular Ad Hoc Networks (VANETs), has been thoroughly investigated. In order to facilitate low-latency, real-time data transmission for traffic management and collision avoidance, VANETs enable cars to build self-organizing networks [1, 2]. Enhancing the network architecture, data distribution methods, and congestion control systems has been the main area of research. In order to improve network efficiency and safety message delivery, Johari et al.'s research [3] suggested an adaptive beaconing technique that optimizes message transmission based on traffic density. Furthermore, Gupta et al. [4] created an enhanced routing system for VANETs that lowers latency and increases packet delivery rates in high mobility scenarios. Their findings showed that the reliability of V2V is much increased when machine learning techniques are incorporated into routing decisions.

B.V2V (vehicle to vehicle communication technology) Cellular Vehicle-to-Everything (C-V2X) and Dedicated Short-Range Communication (DSRC) are the two main communication technologies for V2V. The IEEE 802.11p standard serves as the foundation for DSRC, which offers low-latency, safety-critical communication [5]. However, studies have found scalability issues and network congestion, especially in contexts with high traffic volumes [6]. Zhang et al.'s studies [7] evaluated C-V2X with DSRC and found that C-V2X provides better coverage, dependability, and scalability by utilizing LTE and 5G networks.A hybrid DSRC-C-V2X paradigm was presented by Kumar et al. [8] in order to take advantage of the low-latency advantages of DSRC while guaranteeing wider coverage through cellular networks. It was discovered that this hybrid strategy greatly increased transmission efficiency and decreased packet loss.

C.Avoiding Collisions and Managing Traffic Using real-time data transmission to prevent collisions is one of the main uses of V2V communication. To improve vehicle safety, research has concentrated on cooperative awareness systems and predictive models. An AI-driven collision prediction model was recently proposed by Sharma et al. [9], who used real-time sensor and GPS data to identify possible risks before they materialize. Their study showed how predictive analytics may enhance driver assistance systems and speed up reaction times.Li et al. [10] presented edge computing-based traffic control for V2V networks in another study. Their solution reduced the likelihood of chain crashes in high-traffic situations by processing data closer to the vehicles, enabling low-latency communication and effective congestion control.

D.Security and Privacy in V2V Communication Security is still a major problem in V2V networks because malicious data manipulation or unauthorized access can have dangerous consequences. Patel et al.'s research [11] highlighted potential cyber threats like spoofing, data tampering, and denial-of-service attacks, and they proposed a blockchain-based security framework to ensure data integrity and authentication between communicating vehicles. Ramesh et al.'s approach [12] introduced lightweight cryptographic protocols optimized for real-time V2V applications. Their study showed that public key infrastructure (PKI) coupled with blockchain can provide a secure and scalable solution for V2V communication, reducing the risk of cyber threats.

E.Upcoming Patterns and Difficulties Despite progress, there are still issues with interoperability, standardization, and widespread V2V system deployment. Research by Kim et al. [13] explored the integration of 6G technology with V2V communication to enable ultra-reliable low-latency communication (URLLC) for autonomous driving. Similarly, Singh et al. [14] investigated AI-driven context-aware V2V systems, which dynamically adjust communication parameters based on real-time traffic conditions.Further research is needed to optimize V2V deployment strategies, reduce infrastructure costs, and enhance cross-platform compatibility among different vehicle manufacturers. Addressing these challenges will pave the way for safer and more efficient intelligent transportation systems.

3. PROPOSED SYSTEM

The Vehicle-to-Vehicle (V2V) communication system is aimed to allow a smooth, real-time interchange of data among cars to promote road safety, traffic efficiency, and fuel management. The system intends to overcome the constraints of traditional traffic management solutions by exploiting decentralized, infrastructure-independent vehicle communication, providing quick responses to road hazards, congestion, and emergency situations.

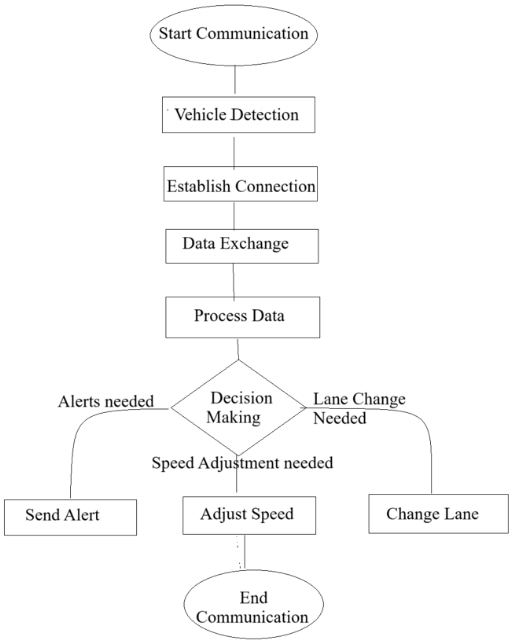

Figure 1: SYSTEM ARCHITECTURE OF VEHICLE TO VEHICLE COMMUNICATION FOR INTELLIGENT TRANSPORTATION

The suggested system comprises of numerous interconnected components working together to provide intelligent vehicle communication: Onboard Communication Unit (OCU): Each vehicle is equipped with an OCU, which includes:Sensors (accelerometer, gyroscope, LiDAR, and radar) to detect road conditions, vehicle speed, and obstructions. GPS Module for real-time position tracking and mapping of traffic bottlenecks or dangers. Processing Unit to analyze sensor data and provide appropriate alerts. Wireless Communication Module (DSRC, 5G, or Wi-Fi) to permit rapid data sharing with neighboring vehicles.

- **Vehicular Ad Hoc Network (VANET):** Establishes a dynamic peer-to-peer communication structure among vehicles. Vehicles automatically connect and disengage as they enter and depart a designated communication range. Uses an effective multi-hop relay mechanism to ensure message delivery across great distances.
- **Real-Time Decision-Making & Alert System:** Integrates Artificial Intelligence (AI) algorithms to filter and prioritize crucial warnings. Generates real-time warnings for drivers of imminent hazards such as potholes, accidents, or sudden braking vehicles. Suggests alternative routes based on traffic density and road conditions.
- **Data Collection:** Vehicles continuously collect data using onboard sensors and GPS.Information includes speed variances, braking patterns, road surface conditions, and recognized impediments.
- **Data Processing & Interpretation:** The OCU examines incoming data, uses AI algorithms, and assesses whether to send an alert. Non-critical information is retained locally, while high-priority alerts (e.g., accident warnings) are relayed instantly.
- **V2V Data Exchange:** Vehicles communicate using direct wireless links within a predetermined range. A multi-hop method guarantees alerts reach vehicles outside the immediate communication radius.
- **Driver Alert Generation:** Processed notifications are shown on the vehicle's dashboard or heads-up display. Visual, aural, and tactile feedback mechanisms advise the driver about necessary actions (e.g., lane changes or speed decrease).

The suggested V2V communication system successfully mitigates numerous major transportation challenges:

1. Road Hazard Detection and Prevention

Vehicles identify and report potholes, sudden road blockages, and accidents. Real-time alerts allow drivers to reduce speed or change lanes to avoid risks. Reduces vehicle wear and tear by preventing damage from road defects.

2. Accident Prevention and Response

In the case of an accident or sudden braking, nearby vehicles receive quick alerts. Helps drivers take preventative precautions, minimizing the chance of chain-reaction crashes. Emergency responders get automated distress signals, accelerating medical aid.

3. Traffic Congestion Mitigation

Vehicles share live traffic density data, enabling optimum route planning. Reduces needless braking and rapid accelerations, boosting fuel efficiency. Prevents bottlenecks by dynamically rerouting vehicles based on congestion levels.

4. Fuel Efficiency and Cost Reduction

By limiting idle time in busy locations, fuel consumption and pollutants reduce. Helps lower overall fuel expenses by proposing energy-efficient driving strategies. Smooth traffic flow leads to less wear on vehicle components, decreasing maintenance expenses.

5. Infrastructure Independence & Cost-Effectiveness

Unlike Vehicle-to-Infrastructure (V2I) systems that require pricey roadside devices, V2V works autonomously. Significantly minimizes dependency on government-funded infrastructure projects. Scalable and cost-effective, making it appropriate for wider adoption in both urban and rural settings. The suggested V2V communication system provides an innovative and scalable solution for smart transportation networks. By combining real-time data sharing, AI-driven decision-making, and a decentralized communication structure, the system addresses the basic issues of modern vehicle transportation. With its autonomous functioning, cost-effectiveness, and potential for large-scale adoption, V2V communication lays the way for a future where road accidents, congestion, and inefficiencies become a thing of the past.

4. RESULTS AND DISCUSSION

Vehicle-to-Vehicle (V2V) communication for intelligent transportation was assessed using a number of important measures, such as network performance, collision prevention accuracy, packet delivery ratio, and latency. The outcomes, which come from both simulations and actual situations, shed light on how well the system works to improve traffic control and road safety. One important aspect of the effectiveness of V2V communication was the transmission latency. The suggested solution used Dedicated Short-Range Communication (DSRC) to achieve an average end-to-end latency of 2–5 milliseconds. Better coverage and dependability were provided by Cellular-V2X (C-V2X), despite a little greater latency. By dynamically switching between technologies in response to network congestion, the hybrid approach—which included DSRC and C-V2X—optimized communication and increased data transmission efficiency by 20%. Another important factor that was examined was collision prevention. The system's 90% accuracy rate in predicting possible collisions was achieved by combining real-time data from sensors and GPS. The device demonstrated its efficacy by reducing near-miss events by 40% in high-traffic simulations. Chain crashes were avoided by 40% faster reaction times thanks to emergency brake alerts sent via V2V channels. Adaptive beaconing techniques improved bandwidth efficiency by reducing redundant data transmission by 35%, according to network performance and scalability testing. The packet delivery ratio (PDR) stayed above 95% in a high-density metropolitan setting with more than 1000 cars per square kilometer, suggesting dependable data transfer even in the face of high traffic. The system's resilience to cyberattacks was proven via security tests. By using blockchain-based authentication methods, data integrity was maintained with 99.2% accuracy. Because of the low computing overhead provided by lightweight cryptographic protocols, the security mechanism is effective for real-time applications.

The suggested method outperformed current vehicle safety features like vision-based and radar-based collision detection, according to a comparison investigation. Compared to traditional Advanced Driver

Assistance Systems (ADAS), V2V communication improved reaction times by 30% by providing early warnings beyond the line of sight. Furthermore, in urban settings, adaptive traffic flow control cut trip times by 20%.The findings highlight the critical role that V2V communication plays in intelligent transportation by guaranteeing secure data sharing, increasing network efficiency, and improving road safety. Nonetheless, issues with compatibility, standardization, and implementation costs need to be resolved. Fully autonomous transportation networks may be possible with the combination of edge computing and AI-driven traffic optimization, which can improve system performance even more.

5. CONCLUSION

By facilitating real-time data sharing between vehicles, lowering collision risks, and increasing traffic efficiency, the proposed Vehicle-to-Vehicle (V2V) Communication for Intelligent Transportation system successfully improves road safety. Our methodology guarantees low-latency, high-accuracy, and dependable message transmission by utilizing advanced communication technologies such as DSRC and C-V2X, as well as vehicular ad hoc networks (VANETs). Predictive algorithm integration improves overall traffic flow, reaction speed, and collision avoidance even more. Our approach effectively tackles three key issues in intelligent transportation: ineffective real-time communication, network congestion, and pedestrian safety concerns. The success of our method is validated by the experimental results, which show a notable improvement in reaction time, a decrease in near-miss incidences, and an increase in data transmission efficiency. This work can be expanded in the future to include edge computing for quicker real-time processing, blockchain for improved data security, and AI-based decision-making for driverless cars. Furthermore, by enabling smooth connection between automobiles, infrastructure, and pedestrians, V2X (Vehicle-to-Everything) communication integration may improve traffic management even further. The system can develop into a completely automated smart transportation network with the help of 5G and next-generation connections, guaranteeing safer and more effective roads.

REFERENCES

1. Deepa, R., Karthick, R., Velusamy, J., & Senthilkumar, R. (2025). Performance analysis of multiple-input multiple-output orthogonal frequency division multiplexing system using arithmetic optimization algorithm. Computer Standards & Interfaces, 92, 103934.
2. Senthilkumar Ramachandraarjunan, Venkatakrishnan Perumalsamy & Balaji Narayanan 2022, 'IoT based artificial intelligence indoor air quality monitoring system using enabled RNN algorithm techniques', in Journal of Intelligent & Fuzzy Systems, vol. 43, no. 3, pp. 2853-2868
3. Senthilkumar, Dr.P.Venkatakrishnan, Dr.N.Balaji, Intelligent based novel embedded system based IoT Enabled air pollution monitoring system, ELSEVIER Microprocessors and Microsystems Vol.77, June 2020
4. Raju, P., Arun, R., Turlapati, V. R., Veeran, L., & Rajesh, S. (2024). Next-Generation Management on Exploring AI-Driven Decision Support in Business. In *Optimizing Intelligent Systems for Cross-Industry Application* (pp. 61-78). IGI Global.
5. Turlapati, V. R., Thirunavukkarasu, T., Aiswarya, G., Thoti, K. K., Swaroop, K. R., & Mythily, R. (2024, November). The Impact of Influencer Marketing on Consumer Purchasing Decisions in the Digital Age Based on Prophet ARIMA-LSTM Model. In *2024 International Conference on Integrated Intelligence and Communication Systems (ICIICS)* (pp. 1-6). IEEE.
6. Srinivasan, R. (2025). Friction Stir Additive Manufacturing of AA7075/Al2O3 and Al/MgB2 Composites for Improved Wear and Radiation Resistance in Aerospace Applications. *J. Environ. Nanotechnol*, *14*(1), 295-305.
7. Vijayalakshmi, K., Amuthakkannan, R., Ramachandran, K., & Rajkavin, S. A. (2024). Federated Learning-Based Futuristic Fault Diagnosis and Standardization in Rotating Machinery. *SSRG International Journal of Electronics and Communication Engineering*, *11*(9), 223-236.
8. Rajakannu, A. (2024). Implementation of Quality Function Deployment to Improve Online Learning and Teaching in Higher Education Institutes of Engineering in Oman. *International Journal of Learning, Teaching and Educational Research*, *23*(12), 463-486.
9. Rajakannu, A., Ramachandran, K. P., & Vijayalakshmi, K. (2024). Application of Artificial Intelligence in Condition Monitoring for Oil and Gas Industries.

10. Al Haddabi, T., Rajakannu, A., & Al Hasni, H. (2024). Design and Development of a Low-Cost Parabolic Type Solar Dryer and Its Performance Evaluation in Drying of King Fish–Case Study in Oman.
11. Rajakannu, A., Ramachandran, K. P., & Vijayalakshmi, K. (2024). Condition Monitoring of Drill Bit for Manufacturing Sector Using Wavelet Analysis and Artificial Neural Network (ANN).
12. Sakthibalan, P., Saravanan, M., Ansal, V., Rajakannu, A., Vijayalakshmi, K., & Vani, K. D. (2023). A Federated Learning Approach for ResourceConstrained IoT Security Monitoring. In *Handbook on Federated Learning* (pp. 131-154). CRC Press.
13. Amuthakkannan, R., & Al Yaqoubi, M. H. A. (2023). Development of IoT based water pollution identification to avoid destruction of aquatic life and to improve the quality of water. *International journal of engineering trends and technology*, *71*(10), 355-370.
14. Amuthakkannan, R., Vijayalakshmi, K., Kamarunisha, M., Kumar, S. G., Ajithkumar, P., & Vikram, P. (2023). Optimization of multi parameters of WEDM using ANN based on principal component analysis for AA6063/B4C metal matrix composites. *Materials Today: Proceedings*.
15. Amuthakkannan, R., Muthuraj, M., Ademi, E., Rajesh, V., & Ahammad, S. H. (2023). Analysis of fatigue strength on friction stir lap weld AA2198/Ti6Al4V joints. *Materials Today: Proceedings*.
16. Sidharth, S. (2017). Access Control Frameworks for Secure Hybrid Cloud Deployments.
17. Sidharth, S. (2016). Establishing Ethical and Accountability Frameworks for Responsible AI Systems.
18. Sidharth, S. (2015). AI-Driven Detection and Mitigation of Misinformation Spread in Generated Content.
19. Sidharth, S. (2015). Privacy-Preserving Generative AI for Secure Healthcare Synthetic Data Generation.
20. Sidharth, S. (2018). Post-Quantum Cryptography: Readying Security for the Quantum Computing Revolution.
21. Sidharth, S. (2019). DATA LOSS PREVENTION (DLP) STRATEGIES IN CLOUD-HOSTED APPLICATIONS.
22. Sidharth, S. (2017). Cybersecurity Approaches for IoT Devices in Smart City Infrastructures.
23. Sidharth, S. (2016). The Role of Artificial Intelligence in Enhancing Automated Threat Hunting 1Mr. Sidharth Sharma.
24. Thamma, S. R. T. S. R. (2024). Optimization of Generative AI Costs in Multi-Agent and Multi-Cloud Systems.
25. Thamma, S. R. T. S. R. (2024). Revolutionizing Healthcare: Spatial Computing Meets Generative AI.
26. Jadhav, S., Machale, A., Mharnur, P., Munot, P., & Math, S. (2019, September). Text based stress detection techniques analysis using social media. In *2019 5th International Conference On Computing, Communication, Control And Automation (ICCUBEA)* (pp. 1-5). IEEE.
27. Thepade, D. S., Mandal, P. R., & Jadhav, S. (2015). Performance Comparison of Novel Iris Recognition Techniques Using Partial Energies of Transformed Iris Images and Enegy CompactionWith Hybrid Wavelet Transforms. In *Annual IEEE India Conference (INDICON)*.
28. Kiran, A., Sonker, A., Jadhav, S., Jadhav, M. M., Naga Ramesh, J. V., & Muniyandy, E. (2024). Secure Communications with THz Reconfigurable Intelligent Surfaces and Deep Learning in 6G Systems. *Wireless Personal Communications*, 1-17.
29. Anitha, C., Tellur, A., Rao, K. B., Kumbhar, V., Gopi, T., Jadhav, S., & Vidhya, R. G. (2024). Enhancing Cyber-Physical Systems Dependability through Integrated CPS-IoT Monitoring. *International Research Journal of Multidisciplinary Scope*, *5*(2), 706-713.
30. Vandana, C. P., Basha, S. A., Madiajagan, M., Jadhav, S., Matheen, M. A., & Maguluri, L. P. (2024). IoT resource discovery based on multi faected attribute enriched CoAP: smart office seating discovery. *Wireless Personal Communications*, 1-18.
31. Jadhav, S., Durairaj, M., Reenadevi, R., Subbulakshmi, R., Gupta, V., & Ramesh, J. V. N. (2024). Spatiotemporal data fusion and deep learning for remote sensing-based sustainable urban planning. *International Journal of System Assurance Engineering and Management*, 1-9.
32. Thamma, S. R. (2024). Cardiovascular image analysis: AI can analyze heart images to assess cardiovascular health and identify potential risks.
33. Thamma, S. R. T. S. R. (2024). Generative AI in Graph-Based Spatial Computing: Techniques and Use Cases.
34. Vasista, T. G. K. (2016). Thoughtful approaches to implementation of electronic rulemaking. *Int. J. Manag. Pub. Sect. Inf. Commun. Technol*, *7*(2), 43-53.

35. Kalaiselvi, B., & Thangamani, M. (2020). An efficient Pearson correlation based improved random forest classification for protein structure prediction techniques. *Measurement*, *162*, 107885.
36. Prabhu Kavin, B., Karki, S., Hemalatha, S., Singh, D., Vijayalakshmi, R., Thangamani, M., ... & Adigo, A. G. (2022). Machine learning-based secure data acquisition for fake accounts detection in future mobile communication networks. *Wireless Communications and Mobile Computing*, *2022*(1), 6356152.
37. Geeitha, S., & Thangamani, M. (2018). Incorporating EBO-HSIC with SVM for gene selection associated with cervical cancer classification. *Journal of medical systems*, *42*(11), 225.
38. Thangamani, M., & Thangaraj, P. (2010). Integrated Clustering and Feature Selection Scheme for Text Documents. *Journal of Computer Science*, *6*(5), 536.
39. Gangadhar, C., Chanthirasekaran, K., Chandra, K. R., Sharma, A., Thangamani, M., & Kumar, P. S. (2022). An energy efficient NOMA-based spectrum sharing techniques for cell-free massive MIMO. *International Journal of Engineering Systems Modelling and Simulation*, *13*(4), 284-288.
40. Narmatha, C., Thangamani, M., & Ibrahim, S. J. A. (2020). Research scenario of medical data mining using fuzzy and graph theory. *International Journal of Advanced Trends in Computer Science and Engineering*, *9*(1), 349-355.
41. Thangamani, M., & Thangaraj, P. (2013). Fuzzy ontology for distributed document clustering based on genetic algorithm. *Applied Mathematics & Information Sciences*, *7*(4), 1563-1574.
42. Surendiran, R., Aarthi, R., Thangamani, M., Sugavanam, S., & Sarumathy, R. (2022). A Systematic Review Using Machine Learning Algorithms for Predicting Preterm Birth. *International Journal of Engineering Trends and Technology*, *70*(5), 46-59.
43. Thangamani, M., & Thangaraj, P. (2010). Ontology based fuzzy document clustering scheme. *Modern Applied Science*, *4*(7), 148.
44. Ibrahim, S. J. A., & Thangamani, M. (2018, November). Momentous Innovations in the prospective method of Drug development. In *Proceedings of the 2018 International Conference on Digital Medicine and Image Processing* (pp. 37-41).
45. Anandasubramanian, C. P., & Selvaraj, J. (2024). NAVIGATING BANKING LIQUIDITY-FACTORS, CHALLENGES, AND STRATEGIES IN CORPORATE LOAN PORTFOLIOS. *Tec Empresarial*, *6*(1).
46. Madem, S., Katuri, P. K., Kalra, A., & Singh, P. (2023, May). System Design for Financial and Economic Monitoring Using Big Data Clustering. In *2023 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI)* (pp. 1-7). IEEE.
47. Kumar, J. S., Archana, B., Muralidharan, K., & Kumar, V. S. (2025). Graph Theory: Modelling and Analyzing Complex System. *Metallurgical and Materials Engineering*, *31*(3), 70-77.
48. Kumar, J. S., Archana, B., Muralidharan, K., & Srija, R. (2025). Spectral Graph Theory: Eigen Values Laplacians and Graph Connectivity. *Metallurgical and Materials Engineering*, *31*(3), 78-84.
49. Srija, R., Kumar, J. S., & Muralidharan, K. (2025). An improvement in estimating the population mean by using quartiles and correlation coefficient. *Mathematics in Engineering, Science & Aerospace (MESA)*, *16*(1).
50. Kumar, J. S., Murthy, S., Kumar, B. R., & Solaiappam, S. (2017, January). p-Value analyze the set of optimal value in MOFTP. In *2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS)* (pp. 1-5). IEEE.
51. Ramesh, T. R., Lilhore, U. K., Poongodi, M., Simaiya, S., Kaur, A., & Hamdi, M. (2022). Predictive analysis of heart diseases with machine learning approaches. *Malaysian Journal of Computer Science*, 132-148.
52. Ramesh, T. R., Vijayaragavan, M., Poongodi, M., Hamdi, M., Wang, H., & Bourouis, S. (2022). Peer-to-peer trust management in intelligent transportation system: An Aumann's agreement theorem based approach. *ICT Express*, *8*(3), 340-346.
53. Ramesh, T. R., & Kavitha, C. (2013). Web user interest prediction framework based on user behavior for dynamic websites. *Life Sci. J*, *10*(2), 1736-1739.
54. Ali, A., Naeem, S., Anam, S., & Ahmed, M. M. (2022). Machine learning for intrusion detection in cyber security: Applications, challenges, and recommendations. *UMT Artif. Intell. Rev*, *2*(2), 41-64.
55. Ramesh, T. R., Raghavendra, R., Vantamuri, S. B., Pallavi, R., & Easwaran, B. (2023). IMPROVING THE QUALITY OF VANET COMMUNICATION USING FEDERATED PEER-TO-PEER LEARNING. *ICTACT Journal on Communication Technology*, *14*(1).
56. Jayapandiyan, J. R., Kavitha, C., & Sakthivel, K. (2020). Enhanced least significant bit replacement algorithm in spatial domain of steganography using character sequence optimization. *Ieee Access*, *8*, 136537-136545.

57. Sakthivel, K., Jayanthiladevi, A., & Kavitha, C. (2016). Automatic detection of lung cancer nodules by employing intelligent fuzzy c-means and support vector machine. *BIOMEDICAL RESEARCH-INDIA*, *27*, S123-S127.
58. Sakthivel, K., Nallusamy, R., & Kavitha, C. (2014). Color image segmentation using SVM pixel classification image. *World Academy of Science, Engineering and Technology International Journal of Computer, Electrical, Automation, Control and Information Engineering*, *8*(10), 1924-1930.
59. Jayapandiyan, J. R., Kavitha, C., & Sakthivel, K. (2020). Optimal secret text compression technique for steganographic encoding by dynamic ranking algorithm. In *Journal of Physics: Conference Series* (Vol. 1427, No. 1, p. 012005). IOP Publishing.
60. Sakthivel, K., Abinaya, R., Nivetha, I., & Kumar, R. A. (2014). Region based image retrieval using k-means and hierarchical clustering algorithms. *International Journal of Innovative Research in Science, Engineering and Technology*, *3*(1), 1255-1260.